ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 71.] NOVEMBER. [1892.

CCLXXV.—COFFEE CULTIVATION IN BRITISH HONDURAS.

In a Foreign Office Report [No. 255, Miscellaneous Series, 1892] on the coffee industry of Guatemala, a very interesting account is given by Mr. Roland Gosling of the present position and prospects of the very flourishing coffee industry which has been established in this Central American Republic. In the report it is stated that "the export of "coffee from Guatemala in 1891, amounted to 52,197,853 lbs., valued "roughly at about 2,185,397*l.*, and this year's crop will, it is "confidently believed, be considerably in excess of that of 1891.

"Speaking generally, the climate of Guatemala is singularly healthy, "especially in the coffee zone, which varies in altitude from 1,500 feet "to 5,000 feet above sea level."

Very full information is given respecting the development of coffee cultivation of late years, the price of land, the circumstances connected with the supply of labour, and other questions likely to be of general interest. In conclusion Mr. Gosling mentions that "lands suitable for "the cultivation of coffee are still to be had at a moderate price, and it "is confidently believed that were labour sufficiently plentiful, three "or four times the amount of coffee now produced could be "grown.

"Over 20 per cent. of the owners of coffee estates are Germans, and "this, as has already been stated, is the case with nearly every branch "of industry in Guatemala.

"It is to be hoped that the time is not far distant when Englishmen "will turn their attention to this country and endeavour successfully to "compete with Germany."

This report is of importance at the present time if only as encouraging a hope, long entertained at Kew, that the rich coffee lands of the neighbouring colony of British Honduras, hitherto quite neglected, might be opened to a similarly prosperous coffee industry. The colony of British Honduras occupies the eastern or Atlantic slope of Central America; it closely adjoins Guatemala, from which it is divided by a frontier line, from Gracias à Dios to Garbutt's Falls, of about 85 miles. The high lands of British Honduras are

chiefly in the west or south.* They consist of a succession of rich valleys and forest clad hills from 600 to 4,000 feet in height. The chief industries in British Honduras have hitherto been mahogany and log-wood cutting. Some sugar plantations have been carried on, and owing chiefly to the initiative and energy of a former Governor, Sir Frederick Palgrave Barlee, K.C.M.G., a moderate trade in fruit and other tropical productions has been established with the Southern States of America. The capabilities of the Colony are, however, practically undeveloped. There are grown at present on a comparatively small scale numerous plants, whose cultivation might be very largely extended. Indian corn or maize is the staple food of the Indian and Spanish population, and the returns are given as high as 56 bushels to the acre. Bananas and plantains are cultivated for export, and as regular steam communication with New Orlaans is maintained by means of a subsidy, the produce finds a ready market all the year round. Pine-apples, oranges, limes, and lemons are grown only in small quantities at present. The Caribs supply the local market with pine-apples.

Cocoa-nut planations have been largely extended on the rich lands of the sea board, and on the cays (or small islands) dotted along the coast. The export of cocoa-nuts for the last twelve years has shown a remarkable development. The total number exported in 1887 was 1,469,900, averaging from 12 to 30 dollars per 1,000. An experienced planter in British Honduras states that :—"For those who can wait for "a return on their money for eight years, I do not think that any more "profitable investment of their capital could be made in this colony "than by putting it into a cocoa-nut plantation." Cacao is apparently found wild in the forests of British Honduras. It flourishes on all the banana and plantain estates, and the quality of the produce when properly cured is excellent. The Central American India rubber tree (*Castilloa elastica*) is a native of British Honduras, and the produce is regularly exported. The tree is found on most of the Cohune ridges and especially near the banks and in the valleys bordering Mullin's River, Sittee River, and the Rio Grande. It is very abundant in some localities. The quantity of rubber shipped in 1887 was 23,967 pounds. The vanilla, sarsaparilla, numerous fibre plants, and very valuable hard-wood trees are found in the woods of the interior, but they have, as yet, scarcely received attention.

As regards the cultivation of Coffee the prospects just now are so satisfactory consequent upon very remunerative prices, that the high lands of British Honduras should certainly receive the attention they deserve. Under the guidance of Sir Alfred Moloney, the present Governor, there is little doubt that every encouragement would be given to the development of local industries. So far, only one coffee estate (San Filipe) has been started in the colony. In Mr. Morris' work on British Honduras he gives the following account of this estate in 1882 :—

"One of the chief inducements which drew me to the Cayo was to see a coffee estate about two miles beyond this place under charge of M. Vivenot. In company with the latter, whom I fortunately met at the Cayo, and M. Blanconeaux, we proceeded up the western branch of the Belize River, until we came to a deep, rich, well-sheltered valley surrounded by low wooded hills.

*A Handbook of British Honduras, comprising historical, statistical, and general information concerning the Colony, compiled from official and other reliable sources, is published by William Blackwood and Sons, London and Edinburgh. A new edition is now in course of being issued.

"Here about 100 acres had been cleared and established in coffee under the shade of bananas, with corn as an intermediary crop. The coffee trees, about 30,000 in number, were from one to two years old from the time of planting. Seed had been obtained from Martinique, Trinidad, and Guatemala. As a whole the plantation was in a promising state; in some places the trees were overshaded by bananas, and consequently the plants were weak and "spindled." There is no doubt, also, that the ground had been somewhat impoverished by the excessive crop of corn (maize) which was then being taken off.

"Most of the trees about two years old were, however, bearing their first crop, and looked as if, even at this early age, some two or three hundredweights per acre would be yielded by them. The plantation was well laid out, with roads and intervals of 18 feet dividing the blocks. Naturally, being a pioneering effort, the best mode of procedure adapted to the district could not be obtained at once; and, again, the difficulty of obtaining labour had hampered the undertaking and increased the expense.

"I left the plantation, however, with a favourable impression respecting the possibility of growing good coffee in British Honduras, and I have no doubt that if coolie labour could be obtained, the whole of this western district would soon be dotted over with prosperous plantations. The cost of clearing and cleaning land ready for planting is put down at 6*l.* per acre; the labourers, at present, owing to the remoteness of the district, get from 42 to 50 cents per day."

In 1885 Mr. Edwin Forrest, a Ceylon planter, was employed for a short period in the colony, and he furnished the following account of the San Filipe Coffee Estate:—

Extracts from a Report to the Belize Government on the San Filipe Coffee Estate.

The "San Filipe" Coffee Estate is distant from Belize about 65 miles in a straight line. It is situated in the Western District, near the Cayo, about five miles from the frontier of Guatemala. The approximate elevation is about 500 feet above sea-level. The thermometer ranges from 60° to 90° Fahr. No register of the rainfall has been kept on the estate, nor at the Cayo. It would be very useful to have a rain-gauge and journal kept on this estate, or in the district. The Government might start a rain-gauge at the police station at the Cayo. At the time of my visit (February 1885) about 100 acres of land were said to be opened (judging by number of the plants), but I think that the acreage will be more when surveyed. As regards roads a main road runs through the estate, with branch roads at right angles 25 feet apart. These roads are just now mostly grown over with bush and weeds.

In the nurseries there are about 300,000 healthy coffee plants ready for planting out. The buildings consist of a house of three rooms with stone walls and cement floor and a thatched roof of palm leaves. There are several outbuildings and sheds for animals. A good double disc pulper, by John Gordon & Co., London, is in use on the estate. The stock consists of 26 cows, 9 horse-kind, about 40 pigs; the grazing is good, as the above are all fed on nothing but natural grasses, except the pigs, which get plantains. The estate has produced about 120 bushels of parchment coffee and 1,000 barrels of maize this year. There are besides about 100,000 roots of bananas and plaintains, and the produce from these have been more than could be sold or consumed in

the district. In addition 2,000 cacao plants have been raised from seed and planted out, and 5,000 rubber plants, some mangoes, oranges, and limes. Some of the coffee trees have suffered from over bearing, and they are only three years old last November.

If rain falls every month of the year, as in Belize for 1884, there should be no necessity for shade for coffee, as I am sure the coffee has already suffered from over-shade from the bananas and plantains. . . . . at the south end of the estate on a flat piece of land, thick with grass and weeds, there is the finest piece of coffee on the whole property. This piece of coffee has a dark green appearance, and this spot is without shade.

San Filipe being near the frontier of Guatemala the labourers under advances are tempted to desert. Any attempt to recapture the deserters is futile. This is especially so with the class of men called "Spaniards." . . . . The Indians could easily be induced to work on estates with encouragement. If the coffee enterprise should extend in the western district a good road or railway will eventually be necessary as an outlet for the produce.

(Signed) EDWARD FORREST.

The latest information respecting coffee growing in British Honduras is contained in the following official correspondence which has been communicated to Kew:—

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, 21st September 1892.

I AM directed by the Marquess of Ripon to transmit to you a copy of a despatch from the Governor of British Honduras, and to inform you that the Crown Agents for the Colonies have been requested to send to you the box of samples of coffee therein referred to, for a report for which Lord Ripon will be obliged.

I am, &c.

The Director, (Signed) JOHN BRAMSTON.
Royal Gardens, Kew.

Sir ALFRED MOLONEY to COLONIAL OFFICE.

MY LORD, Government House, Belize, 31st August 1892.

NOTWITHSTANDING the colony's contiguity to one of the principal coffee exporting countries of the world, the Republic of Guatemala, and the altitudes of its Hinterland, which if they do not rival at least compare favourably with the high country of Coban, now viewed, I understand, as the capital of the coffee garden of Guatemala, this Government is frequently asked whether British Honduras is fit for the cultivation of this commodity.

2. On the suitability of the soil and climate there can be no question whatever. In practical proof of such a conclusion I ventured to send to the care of the Crown Agents for the Colonies, on the 10th instant per S.S. "Antilles," a box of coffee as below, containing a sample of what is grown on the San Filipe estate, situate in the Cayo district at an elevation between 300 and 400 feet, and I beg to request that the Director of the Royal Gardens, Kew, be invited to favour this colony with an authoritative opinion on its quality and value.

3. In the consideration of such a cultural industry it must not be overlooked that the principal current difficulties which have to be locally faced and overcome, are insufficiency of labour and comparative inaccessibility, from want of roads whether cart or rail, to the areas best adapted to the growth of coffee. The question of means of communication has been settled in Guatemala sufficiently to have effected an extensive and valuable export in this commodity; it remains unsolved in this Colony, notwithstanding its age.

4. As to the extent coffee culture has reached in British Honduras the yield falls far short of local requirements, as can be readily gathered from the imports of the past five years.

5. *Coffea arabica* appears to be the species of the genus coffee generally grown in Central America, where it has become neutralised, as is the case in those of the West Indian Islands, in which the condition of labour has admitted of its cultivation.

6. On the lowlands of Guatemala *Coffea liberica* flourishes, where its harvesting is facilitated by the fact that its rich heavy berries when ripe do not drop to the ground, a condition of things that should not be lost sight of in this colony where labour is of such moment.

I have, &c.

(Signed) ALFRED MOLONEY,
Governor.

The Right Hon. Lord Knutsford, G.C.M.G.
&c. &c. &c.

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

SIR, Royal Gardens, Kew, 10th October 1892.

I AM desired by Mr. Thiselton Dyer to acknowledge the receipt of your letter of the 21st September, forwarding a copy of a despatch from the Governor of British Honduras on the subject of samples of coffee grown and cured at San Filipe Estate in that Colony.

2. This coffee was received from the Crown Agents on the 20th September. Unfortunately it had been packed in a damp condition, or the package in which it was placed had been exposed to damp on board ship. In any case the condition in which the samples reached this country has had an unfavourable effect upon the report made by the brokers. The coffee was carefully dried at Kew and presented in as dry and attractive a condition as possible, but it was impossible to overcome the injury done to it previous to its arrival here.

3. In order to carry out the wishes of Sir Alfred Moloney the coffee was submitted for report and valuation to Messrs. Lewis and Peat, brokers of Mincing Lane. The circumstance of the dampness was fully explained to them beforehand, and their report is, on the whole, of an interesting and favourable character.

4. The fortunes of this pioneer coffee estate in British Honduras have been followed at Kew for many years. In 1879 the proposal to make a free grant of the land was supported by Kew; and in 1882, I had the opportunity of visiting the San Filipe Estate and reporting favourably upon its condition and prospects (*The Colony of British Honduras*, pp. 50, 51). In 1885 Mr. Edward Forrest, a Ceylon planter, visited the estate and prepared a detailed report upon it for the information of the Government. A copy of this report was afterwards communicated to Kew.

5. It is evident that coffee of very good quality could be grown in British Honduras, and there are large tracts of lands in the interior well

adapted for this cultivation. The principal drawbacks are the want of roads to these lands and a system of coolie or indentured labour to supplement the labour of the negroes and Indians, who are now for the most part engaged in mahogany and logwood cutting. At the present time, large fortunes are made in coffee planting in the neighbouring republic of Guatelama in Central America, and a flourishing coffee industry might also be established in British Honduras if the Government were able to open up the splendid lands in the interior and render them easily accessible from the coast by roads and light railways.

I have, &c.

Edward Wingfield, Esq., C.B.,
Colonial Office, S.W.

(Signed) D. Morris.

[Enclosure.]

Messrs. Lewis and Peat to Royal Gardens, Kew.

6, Mincing Lane, London, E.C.
6th October 1892.

Dear Sir,

We had this pleasure on the 4th instant, and beg to inform you that we have carefully examined the samples of *Coffee* you kindly sent us, and beg to report upon same as follows:—

Samples of Coffee forwarded by the Government of British Honduras.

Sample A.—Round bean, Caricollo, known here as pea-berry. The coffee is grey, mottled, and faded, and according to the sample, to-day's value is about 104*s.* per cwt. If less mixed with overgrown and defective berries, value would be about 2*s.* 4*d.* per cwt. over this.

Sample B.—"*Moca*," is also pea-berry, and on outward appearance may be a counterpart of the above, but if anything, the sample is less mixed and rather smaller. We presume there is no doubt the sample is correct. [Apparently selected pea-berry only.]

Sample C.—Ordinary flat middling size, and is also grey mottled and very faded and open make, value about 100*s.* or 101*s.* per cwt.

Sample D.—*Pergamimo* or parchment. The sample is good and clean, and has been well prepared. The coffee is colory and fresh, but somewhat discoloured and musty, owing to insufficient drying. If thoroughly well dried, and with the advantage of careful sizing, a parcel say of about 100 bags sent here to be cleaned, we think should bring the following prices:—For *bold size*, 108*s.*; *medium*, 104*s.*–105*s.*; *small*, 94*s.*–95*s.*; *triage*, 85*s.*–88*s.*; pea-berry, 110*s.*–112*s.* 6*d.* per cwt.

The samples have no doubt suffered owing to the extremely wet season which prevailed, and probably again in the transit, having been packed damp, necessitating further drying here, and materially altering the character and appearance of the coffee.

We should like to call your attention to the fact that many of the berries have been split and crushed by the pulper, which with more care in working might be avoided.

THE CALIFORNIA PRUNE.

(P. d'Agen.)

(1250. 9/92. 3612)

Harrison & Sons, Lith.
St. Martins Lane, W.C.

We have seen San Filipe estate coffee on the market and sold some in our sale last year, but only a small quantity.

The coffee is good of its kind, and with care and attention in preparation, curing, &c. should rank and compete favourably with Guatemala and other similar descriptions (grown on low lying ground).

Of course it does not compare with fine high grown Vera Paz, but would take its place with the bulk of Guatemala grades.

At the present time, owing to scarcity, a high range of values is ruling for all grades of mild coffee.

We are, &c.

D. Morris, Esq., F.L.S., Royal Gardens, Kew. (Signed) Lewis and Peat.

CCLXXVI.—THE PRUNE INDUSTRY OF CALIFORNIA.

The production of dried prunes is an important industry in many parts of Europe. An account of the curing of the "French plum," a superior sort of prune, was communicated to Kew by Mr. M. W. Colchester-Wemyss, of Westbury Court, Westbury-on-Severn, and published in the *Kew Bulletin*, December, 1890, p. 263. There has lately been issued by the Foreign Office an interesting report on the prune industry of California, illustrated with coloured plates.* This was prepared by Mr. Vice-Consul Moore, of San Francisco, and taken from the Annual Report of the State Board of Horticulture of the State of California. The following extracts, with a reproduction of the plate of the Californian prune (Petite Prune d'Agen), are taken from the report as published by the Foreign Office:—

Introduction into California.

It is to France that California is indebted for this healthful and profitable fruit. Louis Pellier, a French sailor, who had visited many parts of the world, arrived in San Francisco in 1849, and went to work in the mines in Trinity County. He did not succeed well there, and finally removed to San José early in the fifties. Here he established a nursery. He soon after induced his brother Pierre, whom he had left in France, to join him in California, and the two brothers worked the nursery together until the spring of 1856, when Pierre returned to France in order to marry a girl to whom he was engaged. Combining business with pleasure, he secured a large number of cuttings of prunes, grapes, and other fruits, which he brought back with him on his return. His bride and his brother Jean accompanied him, and, together with the box of precious cuttings, they made the voyage successfully, crossing the Isthmus of Panama and arriving in San Francisco in December 1856.

The prune cuttings were procured in the Ville Neuve d'Agen, from whence the common Californian prune derives its name of Petit Prune d'Agen.

---

* Foreign Office, 1892, Miscellaneous Series. United States. Report (with plates) on the Prune Industry of California. London: Eyre & Spottiswoode. Price 11½*d.*

The importance of Pellier's experiment was not at first appreciated. A German nurseryman, named B. Kamp, procured some grafts from Pellier, and also worked for the introduction of the prune. He was one of the first to put out prune trees in orchard row. But comparatively little attention was paid to prune growing, as a speciality, for a quarter of a century after its introduction into the State.

Growth of the Industry.

Probably the oldest orchard of any size in the State is the Bradley orchard, on Steven's Creek Road, about two miles out of San José. This was set out in 1870. The success of this led others to go into prune growing, and the O'Banion and Kent orchard, near Saratoga, was planted in 1878–9, and the Dr. Handy orchard of 100 acres, at Saratoga, followed in 1880–81; in 1881 the Buxton orchard, also at Saratoga, was planted, and prune growing and curing on a large scale became a fixed fact.

From that time the growth of the industry has been phenomenal. The prune industry has been practically the growth of the past decade, for within that period the planting of orchards, their cultivation, and the proper care of their product, have grown into a system. In the prune centre of Santa Clara county, which 10 years since produced not a pound of this fruit, it is now exported by the carload.

Santa Clara county was from the beginning the centre of the prune industry, and there was demonstrated the fact that prune growing would pay, that no extraordinary care was required in cultivation or mysterious skill in preparation. As soon as these facts were known other counties took up the pursuit, until now the prune is found in all except the highest mountain counties in the State. In 1870 there were but 19,059 prune trees in the State, while the Assessor's reports for 1886, which are probably 25 per cent. too low, give the number in the various counties that year at 1,077,841 trees.

Distribution of the Prune.

The prune is a very hardy tree, and will thrive in a wide range of climate and soil and at various elevations. Wherever the greengage plum will grow, the prune can be grown. It will stand severe winter weather, and will grow where the thermometer touches zero. Its favourite habitat, however, is a temperate climate and a warm, generous soil. It can be grown in the Eastern States, but the short seasons there, the numerous pests, and the unfavourable conditions for drying which exists, prevent the East from ever entering the field as a competitor to California in the prune industry. The drying quality of the prune varies very greatly, owing to the varieties of soil in which it is grown. In some localities it will shrink in drying from four to one, while in others two-and-a-half pounds of green fruit will make one pound of dried. The fruit will also vary in different places in thickness and toughness of skin.

The prune is a gross feeder, and wants for its best development a rich and heavy soil with sufficient moisture to feed it. The foothills of Santa Clara county have long been regarded as especially favourable to the prune, but, as experiments in its growth have been made, other sections have been found that furnish all the required conditions, and while Santa Clara county is still, and probably always will be, the centre and most important section of this industry, it is not now the only prune county of the State.

Methods of Cultivation.

The soil required for prunes depends largely upon the stock used, or rather, perhaps, the stock should be selected to suit the soil. A light, deep, sandy loam, not too moist and well drained, is adapted to peach stock, which does well on the sedimentary deposits of the higher valleys. Such soils are warm and light, and experience has proved that peach stock will do better here than on the heavy, clayey lands of the bottoms.

In the heavier soils plum stock does better than peach, and the Myrobalan or wild plum stock is the favourite. It is hardy, forms a good union with its graft, and does not sucker as other plum stock will.

The almond stock is a favourite with many growers who have a rocky subsoil, as it does well in such land, even better than the peach.

Planting the Orchard.

In laying off the orchard it is desirable to have it symmetrical and to economise the land. A little thought and care displayed at the commencement will save much annoyance in after years, and it is no greater task to have the orchard neat in appearance and symmetrical in outline than to have it in a haphazard condition. There are three objects to be considered in laying out the orchards: symmetry of appearance, economy of space, and facility for future care. Of course, the first thing is to get the trees in straight rows, at equal distances apart, and everyone thinks he can accomplish this. But there are various methods of disposing of the straight row, and these methods all have their advocates and each one its advantages. The principal forms are the square, the quincunx, and the hexagonal or septuple. The methods most common in use are the square and the quincunx systems. The most generally adopted is the square system, as the orchard can be changed to quincunx after being planted, even after a number of years' growth, by the addition of a tree planted in the centre of each square.

The square system is the most approved. The orchard is laid off in lines crossing each other, with equal intervals of space, and a tree planted at each crossing of the lines. By this method, at 20 feet apart, 108 trees are planted to the acre.

Varieties.

The principal varieties are the California (the Petite Prune d'Agen), the Bulgarian, the Fellenberg, the German, the Hungarian, and the Hungarian Date Prune, the Robe de Sergent, the Silver, and the Tragedy. Of these the first named is by far the most popular, and forms the true shipping prune of California.

Propagation of the Prune.

The first prunes were grafted on plum stock, but this has grown into disfavour on account of the tendency of plums to throw out suckers; and other stocks, the peach, the apricot, and lastly the Myrobalan plum, have come into use.

There is an intimate relation between soil and stock. For light, sandy soil the peach stock is yet in great favour, and many growers prefer it over all others. Upon heavier soils it does not do so well as does the Myrobalan. For some time apricot stock was the favourite,

but it has now fallen into total disuse. Experience has taught fruit growers a severe lesson. The prune makes a very poor union with the apricot, and when the tree gets to be large enough to catch the wind it invariably breaks off at the joint of the two stocks. In one instance a fruit grower lost 1,000 trees in an orchard.

The Myrobalan, or cherry plum (*Prunus Myrobalana*) has of late come into great favour as a stock for the prune. It is claimed by some growers that the fruit on Myrobalan stock is smaller than on peach stock, but that its flesh is more solid and dries heavier. The influence of the root on the cured fruit is, however, still a mooted question.

The Myrobalan stock comes from France. It is a wild plum of great thriftiness, and is used very extensively in that country for budding stock of the prune. It grows readily from seed and cuttings, and is easily propagated. The seeds are generally sent to this coast in the middle of October, and then they are at once sprouted. Myrobalan of French origin is now the accepted plum stock for California. It has largely displaced the St. Julien and the Myrabelle, as well as the peach. Though described by some authorities as a dwarfing stock, it is found to be sufficiently free-growing in California to suit all purposes, and to form a good foundation for full standard trees. Its leaves are smaller and its shoots finer than the cherry plum tree, grown for its fruit in this State.

The prune is propagated by both budding and grafting. It is customary to bud the young stock first, as, if the bud does not take, it affords an opportunity to graft later in the season, thus giving the nurseryman two chances. The budding season extends from the middle of July to the end of August. The young trees are stripped of their leaves and twigs about 6 inches above the ground, at which place the bud is inserted. The grafting season is in January and February, at which time grafts are inserted in all the plants in which the buds have not taken. The grafting is done as near the surface of the soil as convenient, usually about 2 or 3 inches from the ground. [The whole process of budding and grafting is described at length in the present report, under Propagation of the prune.]

Cultivation.

In the prune orchard, as in all others, careful cultivation pays. A double object is attained by keeping the surface well pulverised. First, the weeds, which draw heavily upon the vitality of the soil, which should be devoted to tree and fruit growth, are destroyed, and the fertilising qualities which they would extract from the land are left for the benefit of the growing fruit. Secondly, it prevents the rapid evaporation of moisture of the soil, the loose surface acting as a mulch, and on dry lands especially, renders the need of irrigation less frequent.

Pruning.

The training of the young tree requires thought, care, and judgment. In the first three years of its life it is to assume the form which it is to retain during its whole existence. Here, again, the individual judgment must be exercised, and conditions of soil, climate and requirments must be considered. Two schools, in regard to pruning, have sprung up, each advocating a system diametrically opposed to the other, and each backing its opinions with plausible arguments—the one favouring high pruning, the other low ; one heavy pruning, the other

light. It is argued in favour of the high cut tree that it is much easier to cultivate the orchard when a horse can be driven under the limbs, than when it is necessary to work under them with a hoe, as when they are trained low. The advocates of high pruning, in answer to the objections that high pruned trees in hot climates are liable to sun-burn, state that they may be planted closer together and thus afford shade for each other. In favour of low pruning it is urged that the limbs bending beneath their weight of fruit will find support on the ground, that the trunks are protected from the sun, and that the fruit is easier to gather.

Yield.

The prune is a prolific bearer, and can be relied upon for annual crops. Unlike many fruits, it does not take an occasional season's rest but will yield its average returns every season. If properly cultivated some fruit may be gathered the third year, and the fourth year will yield a fairly profitable crop; the fifth year will give from 50 to 60 lbs. to the tree, which the sixth year should double. From this time on the tree can be considered as in full bearing, and will give from 150 to 300 lbs. of green fruit annually. The average yield for Santa Clara county is about 300 lbs. per tree. In some instances 600 to 800 lbs. to the tree are reported, and one six-year old tree in Visalia is credited with 1,102 lbs. of green fruit in one season.

Picking and Curing.

The prune is picked from the tree when fully ripe, which is indicated when it passes from light reddish to purple, and by the withering condition of the fruit. It is very important that the fruit be thoroughly ripe, or else when dried it will be devoid of that rich flavour so essential in a marketable fruit. In most sections the prune upon ripening has a tendency to drop to the ground, which fruit is gathered and processed with the rest of the crop. The picking of the fruit, simple as the process appears, is one of the most particular things in prune cultivation Many of the leading growers go over their orchards eight or ten times, gathering the ripest fruit each time. People are kept continually at work in the season gathering the ripe fruit. Starting at one end of the orchard they will work it over, and by the time they have got through the part first gathered is ready for the second picking, and this is repeated until the entire crop is harvested. The object is to get the fruit in its prime condition—rich, full, meaty, and thoroughly ripe. If it dries on the tree a little and begins to shrivel it is none the worse. The fruit is usually allowed to drop on the ground, from whence it is gathered, and no greater assistance is given it in falling than the gentlest tap on the trumk of the tree; a severe shaking even is not allowed. At the last picking the fruit that remains on the tree is gathered with that which has fallen. By this method the fruit is assured of positive ripeness, is solid, and is charged with saccharine matter so desirable in the cured article. The prune will generally drop from the tree when fully ripe, and will not rot even if left on the ground under the trees for several days. As the fruit shows indications of ripening the ground under the trees is generally cleared of all rubbish and worthless fruit, so that when the mature fruit does fall it can be gathered by itself, free from rubbish Sometimes a sheet is placed upon the ground under the tree, and the ripe fruit is shaken into it, after which the sheet is picked up by the corner, and the fruit turned into boxes and loaded on a waggon, to be taken to the drying ground.

Grading and Curing.

Prunes are generally graded before drying, and various home-made contrivances are employed. Some use inclined planes of adjustable slats, the grader being thus available for other fruit than prunes; the large fruit rolls along into receptacles at the bottom, while the small fruit falls through into other receptacles. Other grading devices are made with wire screens, or riddles of different sizes of mesh. Some of them work on the principle of a fanning mill—three or four riddles placed one above the other, each with a slight incline, and a spout on the side, where each grade drops into a box. Some have a long riddle, say 12 feet long, with three different sizes of wire screen on it. This riddle is hung upon four ropes, with an incline; the prunes are thrown in at the higher end, and by shaking it they roll down and fall through the holes into boxes underneath. The first piece of screen should be small, to let only stems and dirt through, and no prunes. This long, hanging screen is also used to grade prunes after drying.

The object to be attained by grading before drying is equality in drying. The smaller fruit dries more rapidly than the larger, and by grading it into two or three sizes, as it comes from the tree, greater uniformity in evaporation is secured, and a more even quality of finished fruit is the result. The grader also removes all twigs, leaves, or other foreign substances which may have become mixed with the fruit in picking.

The next process to which the fruit is subjected is known as dipping. This is one of the most important processes in the whole preparation of the prune for market, and much of the success of the pack will depend upon the person having it in charge. The ripeness of the fruit, the toughness of the skin, and other peculiarities of the fruit have to be considered in the preparation of the lye into which it is dipped, so that no certain rule can be laid down. The object to be attained is to remove the bloom, which fills up the pores, and at the same time crack the skin of the fruit so that evaporation may take place more rapidly. In its natural state the skin of the prune is almost impervious, and unless dipped the fruit would consume weeks if not months in drying. The usual strength of the dip is about 1 lb. of concentrated lye to each 10 gallons of water. The proper strength, however, must be left to the judgment of the operator, and the lye must be sufficiently strong to crack the skin of the prune. The lye must be kept boiling hot during the operation, and not allowed to cool by the immersion of the fruit. The length of time required for immersion also varies according to the toughness of the skin, the soil upon which the fruit is grown, and the age of the orchard, fruit from old orchards and heavy land being tougher than that from young orchards and freer soils. The average time required is about 30 seconds, but the fruit must be withdrawn as soon as the skin shows minute cracks on its surface. If left too long the sugar will ooze through the cracks in drying, rendering the fruit sticky and disagreeable to handle, and causing it to lose much of its best qualities; if it is removed too soon it will not dry well. After their removal from the lye bath, the scalded prunes are next plunged into clean, fresh water, which rinses off all the lye that may have adhered to them in the first operation. This water must be changed frequently to prevent its becoming too heavily impregnated with lye. For dipping the fruit is put into wire baskets, or galvanised pails with perforated sides and bottoms. In the Buxton orchard, at Campbell, in Santa Clara county, a very ingenious device is used, which does the work automatically. The prunes are taken direct from the orchard,

and unloaded into a bin. Elevators raise them to the grader, which removes all twigs, leaves, and rubbish, and assorts the fruit into two sizes. These two sizes each fall into an endless apron, provided with carrying slats, and are carried through the lye baths, which are kept at a boiling pitch by steam pipes, a separate bath being provided for each sized fruit. The apron continues from the lye bath into the rinsing bath, which is kept fresh by a continuous stream of pure water which flows through it, and from the rinsing bath the fruit is delivered to the trays.

Drying is done wholly by the sun. A number of experiments with driers have been made, but the machines were found wholly inadequate to handle the crops, and sunshine was found so much superior that they have fallen into almost complete disuse, and are now used to so limited an extent as to require no consideration in connexion with the prune industry. After the fruit comes from its second, or fresh-water bath, it is spread evenly on trays of a convenient size, usually about two by three feet, made of thin timber and easy to handle, and these trays are placed on the drying ground, a space which has been carefully selected with a view to its full exposure to the sun. The drying season extends from the middle of August until the beginning of November. The length of time required for the complete desiccation of the fruit depends upon the weather, its heat, and the humidity of the atmosphere.

In hot, dry conditions, the fruit requires a shorter exposure than where it is cool and moist. The drying period will vary under these circumstances from a week to a month, and the time at which to remove the fruit from the drying grounds must be left to the judgment of the operator. It should, however, be sufficiently well dried to warrant its keeping under all conditions, but not so dry as to rattle. When sufficiently dried the fruit is taken to the processing house, where it is put into bins to "sweat." This operation requires from two to three weeks, during which period the fruit must be carefully shovelled over several times and thoroughly intermixed. At the end of the sweating season it assumes a black, glossy appearance, and resumes somewhat of its original plumpness.

Finishing.

The next process is that of "finishing." This comprises a second bath, to which the now dried fruit is subjected. This bath is simply boiling water, to which is added such ingredients as the judgment or the whim of the individual grower may fancy will improve the appearance or quality of his fruit. The objects to be obtained in the second dipping are to destroy whatever insect germs may have become attached in drying, and to soften the skin. The fruit should be left in the bath until partially cooked and these ends are accomplished. Some growers add sufficient salt to the dip to make it a fairly strong brine, and this has the advantage of increasing the heat of the water several degrees beyond that to which fresh water can be heated, and making its effect surer. Others add a small quantity of glycerine, glucose, fruit juices, and some few logwood or indigo. This is done for the purpose of improving the appearance of the fruit and adding to its gloss and colour. Many of the most experienced packers decry the addition of any of the last-named articles, claiming that they are ineffective, and do not add either to the quality or appearance of the fruit. In about three hours the fruit will be sufficiently dry for packing.

Before passing the finishing process the fruit is once more run through the grader and assorted into standard sizes for the market.

There are usually six sizes: first, those ranging from 40 to 50 to the pound; second, 50 to 60 to the pound; third, 60 to 70 to the pound; fourth, 70 to 80 to the pound; fifth, 80 to 90 to the pound; and sixth, all below 90.

Packing.

The final operation in the handling of the prune is packing, and here again great judgment is required in putting up a thoroughly good article, that will present an attractive appearance and force its way on the market. Great care must be exercised that no fruit be packed until all surplus moisture between the fruit has entirely disappeared, for if packed while damp the fruit will mould in the packages; at the same time all fruit that is overdried must be thrown out. The skilful packer can tell by the sense of touch just what fruit is fit for packing, and that which is not, as he runs his fingers over the piles before him. Much of the fruit is packed in boxes of 10 lbs., 25 lbs., and 50 lbs. each, but of late there is a growing demand for fruit in sacks, and large quantities are now shipped to the Eastern States in 100 lb. sacks, where it is either boxed by the eastern dealer or sold direct from the sacks to the consumer.

The prune crop of 1889 was variously estimated at from 15,000,000 lbs. to 18,000,000 lbs., and it was sold at fair prices, ranging from 5 c. to 9 c. ($2\frac{1}{2}d.$ to $4\frac{1}{2}d.$) per lb., the average in the market being 2 c. ($1d.$) higher than the imported. The crop of 1890 was expected to fall short, owing to excessive rain upon the bloom, and the excessive moisture in the soil, which caused much of the fruit to drop after having attained a fair size. At the end of the season it was apparent that the output was but very little, if at all, less than the preceding year. Prices for green fruit delivered at the driers' ranged from 21 dol. to 30 dol. (*4l.* 6*s.* 9*d.* to 6*l.* 4*s.*) per ton.

The following table gives the foreign import and California production for the six years from 1885 to 1891, inclusive:—

Year.	Foreign Imports, by years, ending June 30th.		California Production, by years, ending December 31st.	
	Quantity.	Value in currency.	Quantity.	Value in sterling.
	Pounds.	Dollars.	Pounds.	£ s. d.
1885 - -	57,631,820	2,147,505	—	443,699 7 4
1886 - -	64,995,545	2,026,595	2,000,000	418,717 19 4
1887 - -	92,032,625	2,999,648	1,825,000	619,761 19 6
1888 - -	70,626,027	2,197,150	2,100,000	453,956 12 1
1889 - -	46,154,825	1,423,304	15,200,000	294,071 1 5
1890 - -	58,093,410	1,789,176	12,200,000	369,663 19 2
1891 - -	34,281,322	2,054,486	27,000,000	424,480 11 5

The importation of prunes into the United States for the year 1890, to December 31st, was 61,905,782 lbs. valued at 2,819,420 dol. (582,524*l.* 15*s.* 8*d.*), an increase over the importation of 1889 of 18,188,429 lbs., and an increased value of 584,029 dol. (120,667*l.* 2*s.* 11*d.*) The product of the State of California for the same period is given for 1889 at 15,200,000 lbs., and 1890 at 12,200,000 lbs., or 28,517,353 lbs. less than were imported in 1890. It would appear that while the

United States imports form three to four times the quantity of prunes produced by California, there is still a large field for our domestic fruit, and that with our continually increasing population, the danger of over supply is still very remote, and prune growing in California may be relied upon as a profitable industry for years, if not for generations, yet to come.

CCLXXVII.—SUGAR-CANE BORERS IN THE WEST INDIES.

The *Kew Bulletin* for July and August last, pp. 153–178, contained an elaborate report by Mr. Blandford on the borers (more especially the "shot-borer" *Xyleborus perforans*) that infest sugar-canes in the West Indies. This account was illustrated by figures in different stages of the several insects known as sugar-cane borers. The subject appears still to occupy a good deal of attention, and the following letter received at Kew from St. Vincent shows that as regards the moth-borer (*Chilo* [Diatræa] *saccharalis*) steps are being taken to deal with it in a practical way by planters.* It may be well, however, to state that the circumstances vary a good deal in the several islands. The prevailing sugar-cane borer in St. Vincent and Grenada, for instance, may be entirely different from the prevailing borer in Barbados and Trinidad. This fact has not, so far, been so fully recognised as it deserves by those who have written on the subject, and hence a good deal of confusion has arisen amongst planters as to the best steps to be taken in their particular circumstances. For the purpose of assisting in the identification of the several borers the illustration already given in the *Kew Bulletin* will be of service. Where the moth-borer (*Chilo saccharalis*) and the weevil-borer (*Sphenophorus sacchari*) are prevalent it is probable that they attack healthy or sickly canes indiscriminately. The history of their occurrence now extending, in one case at least over a period of more than 60 years, appears to fully bear out this view. As regards the shot-borer (*Xyleborus perforans*) the evidence is by no means conclusive. This may attack canes already infected by either of the other two borers, or it may attack perfectly healthy canes. There is a third alternative which appears to find support amongst several who have investigated the circumstances on the spot, and that is that the shot borer follows the attack of a fungus permeating the tissues of the canes, and rendering them an easy prey to the borer. The occurrence and habit of this fungus appear to require very careful and systematic observation. The specimens of canes infested by fungus forwarded to Kew from time to time by Mr. J. H. Hart have been carefully examined but the results so far obtained are by no means conclusive in favour of adopting the fungus theory as sufficient to account for the widespread injury to sugar canes that have been reported from Trinidad and elsewhere. Many are inclined to believe that the vitality of the present races of sugar cane cultivated in the West Indies has been so reduced that they fall an easy prey to any disease. The circumstances and vicissitudes of season as regards rainfall and temperature are probably more powerful factors than is usually supposed in determining the health and vigour of the canes.

---

* The moth-borer is indifferently referred to as *Chilo saccharalis* or *Diatræa saccharalis*. The former name is adopted in this article.

The following further correspondence respecting borers in sugar canes at St. Vincent and Barbados has been addressed to Kew :—

Mr. J. G. Coull to Royal Gardens, Kew.

Dear Sir, St. Vincent, 7th September 1892.

In the August number of the *Kew Bulletin* I notice an exceedingly good article on the cane borer in the West Indies, by Mr. W. F. H. Blandford.

The disputed point of whether the *Xyleborus perforans* kills the cane or follows the moth borer (*Chilo saccharalis*) will, I think, be nearly set at rest by the knowledge we have gained this season, and by the specimens of canes which I now send on by this mail for transmission to you for Mr. Blandford's information.

The canes sent have been killed by the moth borer, the marks of which do not appear on any part of the jointed cane; but on looking carefully they will be found at the very top of the cane, in the soft pith from which spring the leaves, the body being free from the moth borer holes, but it will be found to be full of those of the *Xyleborus perforans* at the joints, and in the inside of the cane they will also be found, sometimes in great numbers, the cane having the sickening smell of decomposition. These canes were cut out of a piece of *standovers*, that is, canes that should have been cut in June or July, but on account of the rain have been left until next month. In this piece, I suppose, 10 per cent. of the canes are dead, but the remaining ones are free from disease, and show no signs of either the moth borer or the *Xyleborus perforans*.

I therefore think that the opinion of Mr. G. W. Smith of Grenada, and also that of Mr. Herbert H. Smith, is correct, that the cane is attacked by the moth borer, and when the health of the cane has been injured and acidity sets in, then the *Xyleborus perforans* takes possession. This has escaped attention before, because we have always looked for the marks on the jointed part of the cane; but this season has revealed to us that the place which is mostly attacked is the top of the cane, and in most instances the centre leaf is destroyed before it issues out, the cane dies, and is then taken possession of by the *Xyleborus perforans*. In canes on the leeward side of the island the cane is not so hard, and the moth borer enters the joints, but prefers the top even then, sometimes coming out after entering, and going up higher to the soft pith.

I have now no hesitation in saying that attacks by the moth are at periods of between 50 to 60 days, and that the proper time to destroy them is when they attack the young sprouts in May, June, and July, when *all plants* showing signs of disease should be cut out; again careful inspection in August and September, and again in November and December; this, with the burning off of the cane pieces which are affected after cutting, will, I feel sure, *if carefully carried out*, soon rid us of this insect pest. The first can be done with but little injury to the next crop, but *if not done* until later, there is every probability that the number of diseased canes will be largely increased at each period of 50 to 60 days afterwards.

Hoping that the specimens now sent may be of use in elucidating some of the habits of these borers,

I am, &c.

The Director, (Signed) James G. Coull.
Royal Gardens, Kew.

Report on Specimens of Sugar Cane attacked by Borers, from St. Vincent, by Mr. W. F. H. Blandford, F.E.S., F.Z.S.

I have examined the series of sugar canes forwarded to the Royal Gardens, Kew, by Mr. James Coull of St. Vincent, West Indies, to illustrate the points mentioned in his accompanying letter.

They are the apical portions of 11 canes cut at distances from the summit varying from 3 ft. 4 ins. to 5 ft. They show the following points:—

1. All have been attacked by both the large and small borers.

2. The large borers include both the moth borer (*Chilo saccharalis*) and the weevil borer (*Sphenophorus sacchari*, or an allied species). Of the latter a grub and of the former empty pupal skins and one small caterpillar were found, which latter was accidentally lost before it could be carefully examined.

3. The burrows of the weevil, when old, are not readily distinguishable from those of the *Chilo*, but when fresh are packed with a mass of woody fibre different from the more granular excrement contained in the moth tunnels. It is desirable to distinguish when possible the work of these two insects; when grubs are present this will be easy if it is remembered that the weevil grub is legless, whereas the caterpillar has 16 legs.

4. The burrows of the larger borers are all towards the summit of the cane, as described by Mr. Coull. The lowest holes visible on the outside vary from an inch to 39 inches below the tip, with an average of nine inches. They may extend inside the cane for three or more inches below the lowest external hole.

5. The canes are as a rule healthy looking, except for the last 12 inches or so, which contain the tunnels of the larger borers, and are shrivelled and often much decayed. The shrivelling usually corresponds to the length of the burrows inside the cane, and is a fair guide to their extent; it appears to me to have taken place during the life of the cane, and together with the withering of the tops to form a ready means of recognising borer-injury to the summits of standing canes.

6. When allowance has been made for the fact that the caterpillars often leave the cane to re-enter it at another point (which is not likely to be the case with the weevil grubs), seven canes at least show evidence of two or more separate attacks of the larger borers, and in two cases both weevil and *Chilo* burrows occur in the same cane. If the canes are only rarely attacked at the tips, these cases of double injury would be remarkable.

7. However far the burrows extend down the canes, which depends chiefly on the number of separate attacks, the terminal joints are invariably destroyed. The apical crown of leaves is only twice present, and in each case is pierced by borer holes; the tips are eaten completely off, and were only held in place by the surrounding leaves.

8. The injury to the extreme tips appears to be always caused by the moth-borer.

9. The holes of the small shot-borers (*Xyleborus perforans*) are commonest in the lower part of the stem and become fewer upwards, ceasing in one or two cases in the middle of the portion sent. They recommence in the neighbourhood of the large burrows, and are there always present, but if the top of the cane is very rotten only a few are to be found. A favourite point of attack is the first or second node just below the large burrows.

10. Most of the larger borer holes are old and untenanted, whereas the *Xyleborus* burrows are recent and contain living insects in all stages. As exit holes are only present in one or two canes, the *Xylebori* cannot have inhabited them long, and must have followed the large borers in point of time. In fact, some of their attacks have been begun since the canes were cut and packed.

11. Abrasions on the cortex of the cane, which may result from the nibbling of a caterpillar, or from injury received in trashing, lead in almost every case to entrance holes of the *Xylebori*, showing that these are ready to avail themselves of any assistance in the work of tunnelling the canes.

12. I have counted the entrance holes of the *Xylebori* on eight canes; out of 98 which occur singly, or at most two to a node, 52, or more than half, are in the bud or just at its base. If they are all reckoned the average is less, for out of 12 holes in a node, only two or three will be made in the eye. The *Xylebori* have obviously a preference for boring into this weak point, and in these particular canes do not appear to attack the aerial root-points.

13. The box, made of soft and rather new deal, in which the canes were packed, was attacked by the *Xylebori*.

Mr. Coull is right in his account of the injury done to the tips, and it is most important that this shall be taken into account in any investigations. I cannot find that special attention has been called to it before, but Mr. H. H. Smith has observed that the eggs of the *Chilo* are laid on the young cane leaves which will be near the summit in older plants, and it remains to be seen whether this attack on the extreme tip of the cane is general or whether it only takes place on the old canes (*standovers*) from which these specimens have been cut. As they were selected to show this point I have no means of telling except from Mr. Coull's statements whether it is common. The period of 50–60 days which he gives as that between the successive broods of the moth borer agrees with the statements of other writers, but some give it as 5–6 weeks. As it is founded, like the rest of his statements, on careful observation, it is no doubt accurate. He has not observed the distinction between the *Chilo* and *Sphenophorus* attacks, nor recorded the life-period of the latter. As the caterpillars of the *Chilo* hibernate in the canes his account shows that these infested tops, unless carefully destroyed, may be dangerous centres of infection.

(Signed) W. F. H. Blandford.

Royal Gardens, Kew, to Colonial Office.

Sir, Royal Gardens, Kew, 10th October 1892.

In continuation of my letter of the 8th August on the subject of borers in sugar cane in the West Indies, I am desired by Mr. Thiselton-Dyer to forward a copy of a letter received from Mr. James G. Coull, of St. Vincent, through Messrs. Porter, Goodwin, & Co.

2. This letter was accompanied by specimens of sugar canes attacked by borers, and both the letter and specimens were referred to Mr. W. F. H. Blandford, F.E.S., F.Z.S., to whom Kew is indebted for much valuable research in regard to borers in sugar cane in the West India Islands.

3. Mr. Blandford has furnished a detailed report on the canes (a copy is enclosed herewith) and he supports in the main the results

obtained by Mr. Coull. It is evident that in St. Vincent, at least, there is a practical effort being now made by the planters to deal with the borers in their cane fields. Mr. Thiselton-Dyer is of opinion that a copy of this correspondence may be usefully communicated to the Governments of Barbados, the Windward Islands, and Trinidad, for the information of those locally interested in the sugar industry.

I have, &c.

Edward Wingfield, Esq., C.B., Colonial Office, S.W. (Signed) D. Morris.

Captain N. Forte to Royal Gardens, Kew.

7, The Paragon, Clifton, Bristol,
September 29th, 1892.

Sir,

I shall be much obliged if you would let me have a copy of the *Kew Bulletin* that was issued a few months back containing an account of the *Chilo saccharalis*. I have just arrived from Barbados where I have sugar estates which are suffering to some extent from this pest.

Since April last the managers on my estates have been cutting out regularly all the canes that are attacked by this moth, but this process cannot any longer be continued as the canes are now nine months old, and too thick for the labourers to search.

I understand that this moth is always present in the island, but it is only during the past two years it has caused any damage. Heavy and continuous rains that have prevailed since May have not done any injury to this moth, which is just as active now as it was prior to the rains setting in.

I understand that 70 years ago this moth did a good deal of injury in Barbados. I have this from an eye-witness. Unfortunately a great many planters in Barbados take no notice of this moth, and allow it to commit its depredations.

I am, &c.

D. Morris, Esq. (Signed) N. Forte.

Captain N. Forte to Royal Gardens, Kew.

7, The Paragon, Clifton, Bristol,
October 6th, 1892.

Dear Sir,

I thank you very much for your letter of the 30th September and the *Kew Bulletin* for July-August, which I have carefully studied, and compared with the observations I made during the past seven months spent in Barbados.

My own opinion is that the borer pest is caused by—

1. Drought.
2. Over-cultivation and the extensive use of artificial manures.
3. The degeneracy of the sugar-cane plants.

As it is only possible to deal with the second and third evils, I propose to reduce the cultivation of the cane and obtain a new breed of plants.

I have also planted on the borders of the fields on one of my estates the Pigeon Pea, which is supposed to attract the Ichneumon Fly which is stated, *by a very old planter*, to be parasitic on the *Chilo saccharalis*.

I am, &c.

D. Morris, Esq. (Signed) N. Forte.

CCLXXVIII.—SISAL HEMP INDUSTRY IN YUCATAN.

A general review of the Sisal Hemp industry in various parts of the world was given in the *Kew Bulletin* for February last. Those specially interested in the subject cannot do better than obtain a copy of that number. A later account of the fibre industry in the Bahamas was communicated to Kew by his Excellency Sir Ambrose Shea, K.C.M.G., and published in the *Kew Bulletin* for May and June last, pp. 141–143. What seems to have been required to supplement and complete these accounts was some precise and detailed information respecting the various machines in use in Yucatan for extracting the fibre. It was felt that the success of the whole industry depended in a great measure upon this one point.

At the request of Sir Ambrose Shea, Captain E. Jerome Stuart, the Resident Justice of Long Island, was deputed to proceed to Yucatan with instructions to study the whole subject of fibre cultivation and production in that country and draw a comparison between the circumstances of Yucatan and Bahamas as regards soil, climate, and the general healthiness of the plants. Captain Jerome Stuart gave particular attention to the character of the machinery used for extracting the fibre, and he gives the results obtained from each machine. This part of his report will be read with interest. There are apparently no insuperable difficulties met with in Yucatan in extracting the fibre from Agave leaves. The total exports of fibre from Yucatan are of the annual value of more than a million and a half sterling, and if, as is shown by Captain Jerome Stuart, this large and valuable industry is capable of being continuously carried on by means of machines in regular use there should be no difficulty in selecting one or more of these machines for use elsewhere. The only advantage possessed by Yucatan is apparently that of cheap labour. The rate of pay of the Indians on fibre estates is much below that of negroes in the West Indian islands; but if the higher value of the Bahamas fibre is maintained, Yucatan would appear to possess no advantages not shared by other countries.

Report on the Fibre Industry of Yucatan addressed to Sir Ambrose Shea, K.C.M.G., Governor of the Bahamas, by Captain E. Jerome Stuart.

In accordance with instructions received from your Excellency on the 15th ultimo, I sailed on that date for Yucatan, for the purpose of comparing the soil of the Bahamas and its adaptability to the fibre industry, with the soil of that State: to find out the different species of Agaves planted, and their liability to disease: the character of the machinery used for extracting the Henequen fibre and the cultivation and general management of the crops.

When in the State I visited 28 Henequen estates, and after careful inquiry I have the honour to submit the following report:—

The Soil of Yucatan compared with that of the Bahamas.

The soil in the "fibre producing district" of Yucatan is gravelly and stony, and varies in colour, being black, brown, and red. There are large tracts of land in the district, similar to that on most of our islands,

and known as "mixed land." The soil has an average depth of 8 inches, and is underlaid by soft limestone rock, similar to that of our "Pine Barren" lands.

The largest fibre fields in the State are to be found on this shallow stony soil; and the yield of fibre is greater than on the deeper soil 30 miles further inland.

I could not, when looking at the fibre fields of Yucatan, doubt for a moment that the fibre fields of this colony are equally good; and if the growth of plants is any guarantee of the virtue contained in the soil in which they grow, I do not hesitate in saying that the soil of the Bahamas is equally as good as the soil of Yucatan.

Any one who will look over the grounds of Fort Charlotte will see the soil, trees, and weeds of the fibre fields of Yucatan, with this difference, that the soil there is more stony.

The Different Sorts of Agaves.

There are several species of Agaves to be found in Yucatan, but as two only are of chief commercial value, I confine my report to those two.

The Henequen.—The kind of fibre plant growing in Yucatan, and known as the Sacqui or Henequen is a different and distinct Agave from that of the Bahama hemp.

The plant is hardy, and has, when cultivated, an average life of 18 years; and propagates itself by sending out "suckers" from its roots.

The Henequen (*Agave rigida* var. *elongata*) requires from five to eight years growth to produce a marketable length (3 feet) of fibre. The leaf from which the fibre is extracted has a thorn at the point, and spines on its edges, and averages 3½ feet in length.

The fibre of the plant is white, but being inferior to that of the Bahama Hemp is rated in the market at from 6*l.* to 8*l.* per ton lower.*

The Bahama Hemp.—The Bahama Hemp (*Agave rigida* var. *sisalana*) differs from the Henequen inasmuch as the leaves are without spines on their edges; and the fibre is superior in texture. The plant matures from two to three years earlier than the Henequen, and has an average life of 12 years. Like the Henequen it propagates itself from suckers, but is also capable of producing over 2,000 plants from the pole that grows from the centre of the plant.

The Bahama Hemp is found both in Yucatan, where it is known as the Yaxqui, and in Cuba, but it is not largely cultivated, as it requires a more congenial climate than these countries afford. In this colony the plant luxuriates, the length of leaf being 4½ feet to 5 feet, weighing 1½ to 2 lbs. In Yucatan a leaf of the Yaxqui from a plant of the same age would measure 3¼ feet, and weigh 11 ounces only.

The Plant's Tenacity of Life.

The Henequen and Bahama Hemp are the hardest of all the Agaves. Their power to withstand drought is almost incredible. I have known plants of the Bahama Hemp to lie on the ground for three months, exposed to the rays of the sun, and when planted to grow with the greatest vigour.

It has never been known for these plants to be troubled with any organic disease. No fungus or insect can apparently damage or affect

* At present date, 20th June, rated at 6*l.* lower.

them ; and, in 1883, when the locust devastated the State of Yucatan, the cattle and birds died of starvation, and men were on the eve of despair, the only green living plants to be seen were the different species of Agaves, and they are now looked upon as the salvation of the State.

Although not apparently subjected to disease, and capable of resisting a drought of 11 months in 12, the plant is not altogether free from the effects of sudden changes of heat and cold, and is liable to be damaged by floods of rain immediately after a long drought, if accompanied by a *sudden fall of temperature*. This happened in Yucatan in 1888, when, after a severe drought, the rains came on suddenly, with hail and a heavy wind from the north-west, with a fall of temperature from 89 deg. to 57 deg., and within one night about 90 per cent. of the plants were damaged or blasted on the ends of the leaves, about an average of three leaves to the plant being affected, causing a loss of 3 per cent. to 5 per cent. of leaf. A similar change after a protracted drought happened in this colony in March last, when a few of our farms were affected; but after cutting off the ends of the injured leaves there was nothing more seen of the trouble, and the plants remained healthy and strong. I am told that this frequently happens in Florida, as the atmosphere is more changeable than in the Bahamas; but as this colony is protected by the Gulf stream, there is no probability of its happening here with frequency, and in Yucatan it has happened once only in 30 years. The blast is caused by a sudden atmospheric change over which we have and can have no control, and may happen at any time; but the loss of leaf, 3 per cent. to 4 per cent., even 5 per cent., would be so slight that it may be looked upon with unconcern.

I walked through hundreds of acres of the Henequen, but beyond noticing that a leaf here and there had a few inches dried on its end, similar to what is seen in this colony and Cuba, the plants were perfectly healthy and free from disease.

Kind of Machinery used.

There are several kinds of machinery used for extracting the fibre on the different estates.

Those cleaning less than 75,000 leaves per day use the large common wheels, Raspador and Barraclough; and those cleaning from 80,000 to 120,000 per day use the larger and more complicated machines, the Prieto, Villamore, Weicher, Death and Ellwood, &c.

The planters, if using one of the large machines, keep several of the Raspadors in reserve for use in case of accidents; for should the large machine break down or get out of order, leaving 70,000 or 80,000 leaves on hand, and there be no means of cleaning them, it would involve a loss of over 4,000 lbs. of fibre.

Cleaning Machines.—The *Raspador* is a 54-inch "wheel," said to be invented and manufactured in Mexico. It requires a two-horse power engine to run it at a steady rate of 200 revolutions per minute, at which speed the best results are obtained. Capacity 500 lbs. dry fibre per day of 10 hours; requires the services of two men.

The *Barraclough*, constructed by T. Barraclough & Co., Manchester, England, is similar to the Raspador, but of superior make. Capacity 500 to 600 lbs. dry fibre daily.

The *Prieto* machine is manufactured by Ping and Negre, Barcelona, Spain; requires a 16-horse power engine and the services of two men and a boy. Capacity 7,000 lbs. dry fibre per day of 10 hours. Cost 4,500 dollars.

The *Villamore* machine, made by Krajewski and Pesant, 35, Broadway, New York; requires a 15-horse power engine and the services of two men and a boy. Capacity 6,000 lbs. fibre per day of 10 hours. Frame made of wood. Cost 500 dollars.

The *Weicher* machine, constructed by J. J. Weicher, 108, Liberty Street, New York, is fitted with a service pipe for throwing a stream of water on the fibre as it is being cleaned, and is claimed by the inventor to lose but 1½ per cent. only, as the leaves are fed into the machine endwise. Requires 12-horse power engine and services of three men. Capacity 2,500 lbs. dry fibre per day of 10 hours.

The *Death and Ellwood* machine, constructed by W. E. Death, of Brixton, England, requires a 3-horse power engine to drive it at a velocity of 400 revolutions per minute, and washes the fibre when cleaning. Like the "Weicher," the leaves are fed into the machine endwise. Capacity 250 lbs. [?] of dry fibre per day of 10 hours.

With the exception of the Raspador and Barraclough all the other machines are automatic; they rasp the pulp from the fibre on the same principle as the Raspador. Their wheels being smaller, require a velocity of 500 revolutions to the minute to give good results. Beyond cleaning a greater number of leaves they do not appear to do better work, as the per-centage of loss is as great in the one as the other, and the fibre is equally as clean.

Engines and Boilers.—The engines used were from 6 to 80 horse power, manufactured by Marshal and Son, London; Appleby Bros., London; Fawcett and Preston, Liverpool; Watts, Campbell & Co., Newark, N.J.; H. M. Sciple, Corner 3rd and Arch Street, Philadelphia.

The estates running 60 to 80 horse power engines have two boilers, using them alternately every 15 days.

Press.—Most of the small estates use small screw presses, baling from 3 to 8 bales daily. The large estates, baling 16 to 30 bales daily, use hydraulic presses, constructed by Appleby Bros., London, and Fawcett and Preston, Liverpool.

Locomotive, Tramway Rails, &c.—The locomotive cars are made of wood, 20 feet by 4 feet. The rails are of iron with gauge 3 feet, and sleepers of wood 2 feet apart.

Tramway trucks are of iron or wood; they are 12 feet by 3 feet. Rails and sleepers of iron with gauge 2 feet 4 inches, and sleepers 2 feet apart.

Locomotives and tram cars with rails are manufactured by Charles Wood, Trees Iron Works, Middlesbrough, England.

Cultivation of the Agaves.

The Estates.—There are 200 Henequen estates in Yucatan, varying from 500 to 28,000 acres in extent, having a total number of 105,000 acres under cultivation, employing 12,000 Indian labourers.

The largest and best estates are on the rocky gravelly lands, and they are valued from 100,000 dollars to 500,000 dollars each. Each estate is managed by three principal men—the attorney, the manager, and assistant manager. The largest of them employ locomotives for hauling in the crop from the fields, others using tramway trucks or carts drawn by mules or oxen.

Estates with less than 800 acres under cultivation erect one Raspador for every 100 acres. Those of 1,000 acres use the large automatic machines.

Preparing the Fields.—The size of the cultivations on the estates range from 250 to 3,500 acres. They are laid out in fields or sections of 50 to 200 acres, and contain from 600 to 900 plants to the acre.

When preparing the fields the land is cut during the dry season, is then allowed to spring up, after which it is "sprig weeded," and burnt after the first fall of rain. The stumps are cut close to the ground, so as to be out of the way of the leaves of the plants, and to facilitate the running of the line for planting and getting the rows straight.

Planting.—The plants are "set out" on the different estates at various distances, being 6 ft. by 11 ft., 5 ft. by 11 ft., 4 ft. by 11 ft., 6 ft. by 10 ft., 5 ft. by 10 ft., 4 ft. by 10 ft., 6 ft. by 9 ft., 5 ft. by 9 ft., 4 ft. by 9 ft., 6 ft. by 8 ft.

The rows are kept perfectly straight, for if they be otherwise there would be the greatest difficulty in getting through the fields.

When planting, the labourers have a small line with the distances at which the plants are to be "set out" knotted on it, and a pole cut to the length that the rows are to be apart. A man and a boy are employed at each line. The boy drops the plants along the row at the distance marked on the line, and then removes the line to the next row, dropping the plants as before. The man does the planting, and is responsible for the rows being straight. When coming to a rock the planter does not turn aside, but goes on, and places the plant in the row a little beyond.

The row system facilitates weeding, admits a free current of air and sunlight, which is necessary to harden and give strength and texture to the fibre; allows the labourer to cut and bring out the leaf with despatch; and, what is of the greatest importance, gives room for replanting the field when the life of the old plants is about to terminate, which cannot be done if the plants are growiug over the field irregularly.

Plants of less than 15 inches are not planted.

Management of the Crop.

Cutting.—In Yucatan the Henequen matures in five to eight years. In the Bahamas the Bahama hemp matures in three to five years.

To neglect cutting the leaves after the plant is matured retards its growth, which causes it to "pole," at the appearance of which the life of the plant is ended, and the planter, after reaping a few leaves only, must then plant his fields afresh. On the other hand, when the cutting is regularly attended to, the life of the plant is prolonged, the plant will produce a greater number of leaves, and fibre of a greater length and superior quality.

The plant is cut every three months, when seven to nine leaves are gathered. The leaf is taken from the plant with a "clean cut," making the cut down and inward at an angle of 45 deg.

Cleaning.—As soon as the leaves are cut they are taken to the machine for cleaning. The cleaning is so arranged that one-half of the leaves to be cleaned is taken from the cuttings of the day previous, and the other half from the cuttings of the same day, as in this manner the work can be commenced early in the morning, and steadily carried on without waiting for leaves to be brought in from the field. The leaves are not allowed to accumulate beyond half a day's cleaning, for if left to dry beyond the second day they become hard, and the fibre when extracted will be dark.

When the Raspador is used for extracting the fibre two operators are required; one stands to the left of the wheel and the other to the right. The operator on the left taking a leaf fastens the small end with a lever

to prevent the whole of it being drawn into the machine; the larger end is inserted and cleaned; the other operator then hauls out and reverses the leaf, putting in the uncleaned end, at the same time taking a turn with the cleaned end of the leaf around a brass cleat which is fitted to the machine for the purpose, and managing a brake that regulates the pressure required for cleaning the leaf, finally drawing out the clean fibre. In this manner 14 leaves per minute, or 8,400 leaves are cleaned for a day's work.

When cleaning with the Villamore, Prieto, or other automatic machines, all that is necessary is to lay the bundles of leaves on a platform fitted for the purpose, when an endless chain draws them into the machine, the mechanism of which is so arranged that one wheel cleans one-half of the leaf, the chain taking it along, where another wheel cleans the other half, and then throws out the clean fibre at the opposite end. Two men and a boy are employed at the machine, one man to see that the leaves enter the machine on their length, and that they do not ride one on the other; one to attend to and regulate the machine, and the boy to receive the fibre as it is brought out by the endless chain.

As soon as the fibre is extracted it is dried, for if allowed to remain without being exposed to the sun immediately after cleaning it becomes dark and spotted.

Yield per Acre.—The yield of fibre from an acre of Henequen is from 1,000 lbs. to 1,470 lbs. per annum. The number of plants usually set out in an acre is 650, giving an average of 33 leaves from each plant, and from 50 to 70 lbs. of clean fibre to the 1,000 leaves. Making an average calculation of 650 plants to the acre, 33 leaves from each plant, yielding 60 lbs. of fibre to the 1,000 leaves, the return would be as follows:—$33 \times 650 = 21{,}450$ leaves yielding $60 \times 21\frac{450}{1000} = 1{,}287$ lbs. clean fibre per annum. The planters never speak doubtfully of their returns, as experience shows them that their crops can be relied on with almost complete certainty.

Cost of Working and Profits.—The planter estimates his crop to cost for cultivating, cutting, cleaning, baling and marketing from $2\frac{1}{2}$ cents. to 3 cents. per lb. At the present price of fibre 5 per cent. per lb. taking 3 cents. as the cost of production, an acre yielding 1,287 lbs. would give a net profit of 25 dollars.

After comparing the soil and plants of the Bahamas with that of Yucatan, I assure your Excellency that the one compares most favourably with the other; and that we have in this colony every requirement for the development of the enterprise, and I am most sanguine as to the ultimate result of the Bahama Hemp industry.

(Signed) E. Jerome Stuart.

CCLXXIX.—LIBERIAN COFFEE IN THE MALAY NATIVE STATES.

Continued attention is being directed to the cultivation of Liberian coffee in different parts of the world. There are grounds for believing that the neglect into which it had fallen of late years is being gradually replaced by a greater interest in the capabilities of the plant, and in its undoubted value for cultivation at low elevations and in climates quite

unsuited to the ordinary Arabian coffee. From time to time articles have appeared in the *Kew Bulletin* on the subject,* while a general review of the progress of the industry is given in the number for November 1890, p. 245. The more important plantations yielding regular crops of Liberian coffee are established in Java and in the Straits Settlements. In the latter the yield of per acre in full bearing is given as ranging from 9½ cwts. to 11½ cwts. per acre. Placing the price of Liberian coffee as low as 90*s.* per cwt., this would show a gross return of from 42*l.* to 52*l.* per acre. This is a higher return than is obtained from almost any plantations of Arabian coffee. These figures, it should be remembered, are based on returns supplied to Kew by an experienced and competent planter, and the details are given below.

Liberian Coffee Crops from Estates in the Protected Native States of the Malay Peninsula.

Planters will be interested in the following statement of the produce of Liberian coffee estates in the native States.

	Produced.	Average per Acre for Years in Full Bearing.
Linsum Estate, in Sungei Ujong—	Piculs. Cwts.	
Weedy at times.		
In 1884, 28 acres under 4 years old „ 12 „ „ 3 „	84 or 99	
In 1885, 28 „ over 4 „ „ 12 „ under 4 „ „ 25 „ „ 3 „	312 „ 307½	
In 1886, 40 „ over 4 „ „ 25 „ under 4 „	311 „ 369	
In 1887, 65 acres of coffee in full bearing	345 „ 409½	
„ 1888, 65 „ „ „	542 „ 643½	
„ 1889, 65 acres in full bearing	615 „ 732	
„ 1890, 65 „ „	583 „ 692	
	2,477	
Average per acre for 4 years in full bearing	- - -	9½ cwts.
S'lian Estate, in Sungei Ujong—		
Weedy at times.		
In 1885, 8 acres under 4 years old „ 28 „ „ 3 „ „	78 or 92	
In 1886, 8 „ „ 5 „ „ „ 28 „ „ 4 „ „ „ 9 „ „ 3 „ „	284 „ 336	
In 1887, 36 „ „ 5 „ „ „ 9 „ „ 4 „ „	208 „ 238	
In 1888, 45 acres in full bearing	417 „ 495	
„ 1889, 45 „ „	396 „ 471	
„ 1890, 45 „ „	409 „ 481	
	1,447	
Average per acre for 3 years in full bearing	- - -	$10\frac{7}{16}$ cwts.

* *Kew Bulletin*, 1888, p. 261; 1890, pp. 107 and 245.

	Produced.	Average per Acre for Years in Full Bearing.
Weld's Hill Estate, in Selangor—	Piculs. Cwts.	
Clean.		
In 1886, 19 acres under 4 years old - - - }	274 or 325	
„ 36 „ over 4 „ „ - - - }		
In 1887, 55 acres of coffee in full bearing - -	339 „ 402	
„ 1888, 55 „ „ „ - -	422 „ 501	
„ 1889, 55 „ „ „ - -	552 „ 657	
„ 1890, 55 „ „ „ - -	327 „ 376	
	1,936	
Average per acre for 4 years in full bearing - -	- - -	$3\frac{8}{10}$ cwts.
Batu Caves Estate, in Selangor—		
Weedy at times.		
In 1888, $11\frac{1}{4}$ acres under 4 years old - - -	66 or 78	
„ 1889, $11\frac{1}{4}$ „ 5 „ - - -	61 „ 72	
„ 1890, $11\frac{1}{4}$ acres of coffee in full bearing - -	111 „ 131	
Average per acre for 1 year in full bearing - -	- - -	$11\frac{1}{2}$ cwts.

Remarks.

Crop was lost in 1884, 1885, 1886, and 1887, from want of labour.

The crop on Weld's Hill was thrown back by heavy pruning and unsuitable weather for ripening.

The crops for 1891 will not decrease these averages.

Mr. T. H. Hill to Royal Gardens, Kew.

Dear Sir, Sungei Ujong, May 19th, 1892.

* * * * *

I enclose you the returns of crop on my estates for 1891. You will see they are in a different form, as I now have the yield kept separately, field by field, to enable me to use my manure to the greatest advantage.

* * * * *

Yours, &c.

D. Morris, Esq., (Signed) T. H. Hill.
Royal Gardens, Kew.

Sungei Ujong.—Linsum Estate.

Crop from 1st January to 31st December 1891.

Area in Acres.	No. of Field.	Date planted.	Age.	Boxes of Cherry.	Clean Coffee in Piculs.*	Yield per Acre in Piculs and Catties.	Remarks.
15	1	May to July 1881 -	11 years -	1,085½	111	7·40	
25	2	Early 1880 -	11 years & 5 months.	1,873	200	8·	Very wide planted.
35	3	December 1887, May 1888.	4 years & over.	197½	21½	·60	Old cacao land planted. Many vacancies.
22	4 & 5	April to June 1882	10 years -	1,760	188	8·50	
18	7	October to November 1888.	3 years & over.	131	14½	·70	The out-turn is taken on the average whereas on young coffee 8 boxes make 1 picul.

* A picul = 133⅓ pounds.

Sungei Ujong.—S'lian Estate.

Crop from 1st January to 31st December 1891.

Area in Acres.	No. of Field.	Date planted.	Age.	Boxes of Cherry.	Clean Coffee in Piculs.	Yield per Acre in Piculs and Catties.	Remarks.
4	1	In 1882 - -	10 years -	233	23	5·75	
9	2	May 1882 - -	10 „ -	963	96	10·60	
23	3	August 1882 -	9 years & 8 months.	1,376½	138	6·00	
9	4	September 1883 -	8 years and 7 months.	403½	40	4·40	Close planted.

Selangor.—Weld's Hill Estate.

Crop from 1st January to 31st December 1891.

Area in Acres.	No. of Field.	Date planted.	Age.	Boxes of Cherry.	Clean Coffee in Piculs.	Yield per Acre in Piculs and Catties.	Remarks.
65	—	August 1882 -	9 years & 4 months.	3,614	448·80	6·90	Highly cultivated; *but* estate surrounded by open country. Chiefly grass.
35	—	October 1887 -	4 years & 2 months.	989	122·50	3·50	

Selangor.—Batu Estate.

Crop from 1st January to 31st December 1891.

Area in Acres.	No. of Field.	Date planted.	Age.	Boxes of Cherry.	Clean Coffee in Piculs.	Yield per Acre in Piculs and Catties.	Remarks.
11½	—	May, June, 1884 -	7 years -	535	61·20	5·44	
3½	—	November 1887 -	4 years, 1 month.	151	17·	5·23	
17	—	June 1888 - -	3 years, 5 months.	321	36·71	2·16	Unmanured until 1891.
15	—	Nov. to Dec. 1888	2 years, 7 months.	43	4·84	·21	
7	—	October 1889 -	2 years, 4 months.				

Perak.—Kamming Estate.

Crop from 1st January to 31st December 1891.

Area in Acres.	No. of Field.	Date planted.	Age.	Cherry Boxes.	Clean Coffee.	Yield per Acre.	Remarks.
30	1	October 1888 -	3 years -	735	71·20	51 catties	The full area of each field is given, but owing to failures of first planting, there were not more than 60 per cent. of the original trees, many of which had no crop.
52	1	November 1888 -	3 years, 1 month.				
56	2	December 1888 -	3 years -				

Mr. T. H. Hill to Royal Gardens, Kew.

65, New Broad Street, E.C.,
August 4th, 1892.

My dear Mr. Morris,

Herewith the information that I promised you with regard to my estates on the Malay Peninsula, and also a few remarks that you can utilise if you find them suitable. I should like to sit down and write you a long article about Liberian coffee, and I will do so, but I am so pressed with work that I am unable at present to do more than I have. I will, if you desire it, try and send it you with my next year's crop returns. You see there is so much to be said, and it must be so carefully considered, if the Government get $2·40 per acre per annum from an acre in full bearing, surely they can afford to keep three acres of forest for each acre under coffee, which would still equal a quit-rent of 60 cents per acre on the whole area.

The labour question is another matter that ought to be carefully considered, but I suppose anything beyond a general reference to it would be out of place in the *Bulletin*.

Yours sincerely,

D. Morris, Esq., F.L.S.,
Assistant Director, Kew.

(Signed) T. H. Hill.

[Enclosure].

The returns from these Liberian coffee estates are interesting as showing that under favourable circumstances the yield is not showing any tendency to decrease. Linsum and S'Lian, in Sungei Ujong, estates are surrounded by forest, and the atmosphere there is generally laden with moisture (rainfall from 90″ to 120″) and rain falling on over 200 days in the year, with heavier and more continuous rains in October, November, and the early part of December. The older fields on these estates are manured yearly, and weeds are allowed to grow and have been for many years for a large portion of the year. At certain times the estates are, for periods varying from six weeks to three months, kept scrupulously clean. The cost of cultivation is from $70 to $90 per acre per annum. The soil is not particularly rich, but the climate, from the moisture, makes the estates very productive. The export duty of thirty (dollars) cents per picul produces to the Government an equivalent of a quit-rent of $2·40 per acre, on the land in full bearing.

The younger fields on this estate are finer than the old coffee was at the same age, they all having been planted from selected seed from fine trees, thus getting a pedigree seed, some of the clearings being planted from the 4th generation of seed so selected, and the 5th generation of seed is now in the nursery.

Weld's Hill Estate is in Selangor, and owing to the growth of the town of Qualla Sumpor and its surroundings is in an open plain, so that although the rainfall is much the same, the evaporation is very much more rapid, and the yield of crop is not so large. This may partially be accounted for by the estate being more on the slopes of hills and therefore unsuitable for the growth of weeds. The boundaries of this estate are now being planted up with *Inga Saman*, *Albizzia moluccana*, and other quick-growing trees to alleviate this dry atmosphere as much as is possible. It suggests itself as a matter of grave consideration for the Governments as to how much the capital of these fertile countries is due to their humid climate produced by the large area of forest, and how much to the soil.

Batu Estate has not been manured until 1891, because the soil was so much superior to that of the other estates as to render it theoretically unnecessary to apply manure. In future the same system will be followed as on the other estates.

Kamming Estate.—The yield is very much decreased, owing to the large number of vacancies in the fields, the full areas of which are given, the supplies here are growing luxuriantly, and in a few years these fields will be regular, and from the appearances of the original planted trees, the climate and the soil, the yield should not be less than that on the older estates.

T. H. H.

CCLXXX.—BOMBAY ALOE FIBRE.

(*Agave vivipara*, L.)

In the *Kew Bulletin*, 1890, p. 50, an account was given of a fibre known in commerce as Bombay Aloe Fibre prepared from *Agave vivipara*. It appears that there is a variegated form of this plant in India, and recently through the kindness of Mr. G. Marshall Woodrow, Lecturer on Botany at the College of Science, Poona, several living specimens were obtained for the Kew collections. In forwarding the specimens Mr. Woodrow supplied the following interesting information :—

Mr. G. Marshall Woodrow to Royal Gardens, Kew.

Dear Sir, College of Science, Poona, 19th May 1892.

In reply to your letter of the 23rd April, I have the pleasure of intimating despatch by parcel post of a box containing nine *Agave vivipara variegata* plants, with a mature leaf, and a branch with flowers of the typical plant of this variety.

There are two distinct forms of *Agave vivipara*, one has leaves attaining $4\frac{1}{4}$ feet in length by $2\frac{1}{2}$ inches in breadth at the broadest part, which is near the centre; the other attains $2\frac{1}{4}$ feet in length, but is generally much shorter, it is of the same breadth as the other variety but somewhat thicker. The flowers are the same in both. The Marathee name is *Guial*.

The plant you refer to as having been received from the Bombay Government in 1890 is of the long-leaved variety; the one I send now is a variegated form of the short-leaved variety, it is a very ornamental plant.

I will be glad to send you a large number if you can make use of them, and can give a small plant of the Sisal Hemp in exchange; such plants thrive in this climate. I have lately received two very small offsets of a plant said to be Sisal Hemp, but I am doubtful of their identification.

The two varieties of *Agave vivipara* are grown as fences occasionally throughout South India, but are not found in forest lands or grown as field crops. I made experiments in growing the long-leaved variety as a field crop some years ago, but found that at the then price of the fibre it would be very unprofitable to grow this crop where Sunn (*Crotalaria juncea*) or Ambadee (*Hibiscus cannabinus*) would thrive.

I am much interested in your statement that *Agave vivipara* is the the Bombay Hemp. That name is not known here, I presume it is the London market name. I had not learned it, as the *Kew Bulletin* does not reach me, except the part that gives the list of seeds available for distribution.

Yours, &c.

The Director, (Signed) G. Marshall Woodrow.
Royal Gardens, Kew.

CCLXXXI.—MISCELLANEOUS NOTES.

Mr. William Nicholls Winn, lately the label writer in the Royal Gardens, has been appointed, on the result of a competitive examination before the Civil Service Commissioners, an Assistant in the Royal Gardens from the 1st October last.

An account of an oil, known as Oil of Ben, obtained from *Moringa pterygosperma*, the common horse-radish tree of the tropics, was given in the *Kew Bulletin* for January 1887. Oil of Ben was also supposed to be yielded by *Moringa aptera*, a native of Upper Egypt and Arabia. The latter species was not known in cultivation, and its introduction as a possible source of a valuable oil, was regarded as a matter of some interest. Seeds were obtained by Kew in 1885, and distributed for experimental purposes to Jamaica, Dominica, Calcutta, and Ceylon. A further supply of seed was obtained in 1886 from Mr. E. A. Floyer, Inspector-General of Egyptian Telegraphs. The plants raised from these have now been increased by the addition of two plants presented to Kew by Mrs. Harris, of Steventon Manor, Hants. The young seedlings of *Moringa aptera* form a tuberous root which is eaten by the Bedouins. It is said to be similar in taste to the common radish. The plant has a singular broom-like habit and the very small entire leaves are caducous.

Stapelia Gigantea.—This, the largest flowered of all known stapelias, is now represented at Kew by a specimen bearing six flowers and buds. It is a native of Zululand, where it was discovered by Mr. Plant 30 years ago and sent to Natal, from whence it was sent to England by Mr. Cooper, at that time collector for the late Mr. Wilson Saunders. Although in cultivation so long there is no record of the plant flowering until October 1888, when a specimen in the rich collection formed by the late Sir George Macleay at Pendell Court flowered and was figured in the *Botanical Magazine*, t. 7,068. The flowers vary in size from 8 inches in diameter to 14 inches in diameter; they are coloured pale yellow mottled with red brown, and are covered with fine whitish hairs.

Dischidia Rafflesiana.—After many unsuccessful attempts to introduce living examples of this interesting plant Kew has at last succeeded, thanks mainly to the generosity of Dr. Treub, the distinguished Director of the Botanic Gardens, Java, who sent a plant of it in a Wardian case two years ago. This plant is now established and growing freely, producing numerous large pitcher-like leaves as well as the small normal hoya-like foliage. The morphological meaning of these pitchers has not yet been thoroughly worked out. "The species "of Dischidia all want a careful study. They cannot be described "satisfactorily from dried specimens. The leaves change in form, and "it is not ascertained in respect of many species whether they may or "may not be converted into pitchers (ascidia)." (Hooker in *Flora of British India*). The plant at Kew is now under the special observation of Dr. Scott, Hon. Keeper of the Jodrell Laboratory. *D. bengalensis* is an old garden plant. It is cultivated at Kew in the Palm House. *D. rafflesiana* is for the present kept in one of the propagating pits.

Temperate Ferns.—The collection of ferns in cultivation at Kew is an exceptionally rich one, containing over 2,000 named species and distinct varieties. It is accommodated in the following houses: No. 1, tropical tree ferns; No. 2, tropical ferns and lycopods; No. 3, temperate ferns; the Winter Garden, large tree and other ferns from temperate regions, and the hardy fern rockery. No. 3 house has long been felt to be unsuited for the cultivation of ferns. It was a heavy low-span roofed T shaped structure in part built in 1803. This year it has been pulled down and replaced by a light iron span-roofed house 60 feet long, 23 feet wide, and 13 feet high. It contains a broad central and two side stages with paths on both sides. The old-fashioned belief that ferns require more shade than most plants has given way to the more rational one that ferns under cultivation in the climate of England enjoy plenty of light and rich treatment generally. The best collection of British ferns are grown in rich open borders and treated very much as if they were cabbages.

Xanthorrhœa Tateana, F. V. M.—This grass gum-tree was described by Sir Ferd. Mueller in *Zeitschr. Oesterr. Apoth. Ver.*, 23, 294 (1885). It is a native of Kangaroo Island in South Australia. The Royal Gardens are indebted to Mr. Maurice Holtze, F.L.S., Director of the Botanic Gardens, Adelaide, for two large living stems of this distinct species, which arrived in fine condition on the 8th of October. They are placed in the south end of the Palm House among the large Cycads, and near to the big cactus, *Cereus giganteus*. There are twelve species of *Xanthorrhœa*, all natives of Australia. The other species in cultivation at Kew beside the above are *X. australis*, R.Br.; *X. gracilis*, Endl.; *X. hastilis*, R.Br.; *X. Preissii*, Endl.; *X. quadrangulata*, F.M.; and *X. semiplana*, F.M. Small plants of the last named were received from Mr. Holtze with the stems of *X. tateana*.

A set of Mr. Richard Spruce's "Hepaticæ Amazonicæ et Andinæ" has been purchased. It comprises about 500 species, a very large proportion of which are new, or rather were new, for the published descriptions of them appeared in *Trans. Edinb. Bot. Soc.*, XV. as long ago as 1885. They form part of the very valuable and extensive collections made by Mr. Spruce between 1849 and 1860. The first set of his flowering plants is in the Kew Herbarium.

The last part of Hooker's "Icones Plantarum" (part 2, vol. iii. of the Fourth Series) contains figures of many interesting new plants, notably, *Ixora siphonantha*, Oliver, from Madagascar, with flowers nearly 9 inches long; *Polycardia baroniana*, Oliver (Madagascar), a curious *Celastrinea*, with flowers springing from the centre of the leaves; *Macphersonia macrophylla*, Oliver, from the same country, with dense pendant flower-spikes about 18 inches long; *Didymocarpus pectinata*, C. B. Clarke, a singular species with fern-like foliage, from the Malayan peninsula; and *Tetrachondra Hamiltonii*, Petrie, a remarkable new genus from New Zealand, referred to *Borragineæ*, though in habit and appearance it is very unlike any other member of the order. Indeed it is much more like a *Tillæa*, with which it was found growing in flats and river beds.

Chinese Collections of dried plants still furnish a large number of novelties, and Mr. Hemsley has lately published descriptions (*Journ. Linn. Soc.*, XXIX.) of a selection from Mr. A. E. Pratt's fine collection from Western Szechuen. Among them is a very distinct new species of the genus *Oxyria*, of which genus the widely-spread *O. digyna* was the only previously known species.

It is noticed with regret that at a meeting of the Committee of the Agri.-Horticultural Society of Madras, held on the 1st August last, it was resolved "that the establishment must be reduced in view of "the financial condition of the Society, and that accordingly three "months' notice be given to Mr. J. M. Gleeson, Superintendent of the "Society's Gardens." Mr. Gleeson has been in charge of these gardens since April 1883. He is described by Mr. Joseph Stcavenson, the late Honorary Secretary, as an "able and efficient superintendent, always on "duty and scrupulously honest. His horticultural and arboricultural "skill is as much above that of those of his predecessors I have known, "as his experience is wider and his botanical attainments are higher." Mr. Gleeson was formerly trained at Kew, and his extensive knowledge and experience of Indian horticulture should render him a valuable officer to take charge of gardening operations in the East.